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(74) Agent: PENNINGS, Johannes, F., M.; Internationaal Octrooibureau B.V., Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

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WO 02/13541 A2

(54) Title: SCROLLING MULTI-STRIPE COLOR ILLUMINATION SYSTEM

(57) Abstract: Single panel scrolling color projection systems using three (red, blue and green) scrolling color stripes have been demonstrated to be adequate for television images. However, computer graphics displays are more prone to color artifacts. The invention increases the number of scrolling color stripes in order to suppress these artifacts. One implementation is to break up the three color stripes into multiple bands using a lenticular lens array, and then to collimate the multiple stripes with a second lens array. The collimated stripes are scrolled using the rotating prism of the prior systems.

Scrolling multi-stripe color illumination system

The invention relates to a scrolling stripe illumination system as specified in the characterizing part of Claim 1.

The scrolling stripe illumination system can be used in color projection system.

Scrolling color illumination was patented and implemented in a single panel LC projection system by Philips Electronics North America Corporation, showing a picture quality deemed suitable for television. Computer applications are much more demanding than television because some computer-generated patterns can provoke color break-up, an artifact common to all color sequential displays, much more easily than natural television images. This color break-up makes it more difficult for a color sequential system to penetrate the personal computer monitor market.

Color flashes can be observed in high contrast patterns through rapid eye movements, for instance when blinking. Human sensitivity to this artifact can be explained as a discrepancy between the exposure of the retina's peripheral vision to colored light and the black and white image the central vision system was adapted to.

As prior art, there may be mentioned: US 5,845,981; EP 601,666; EP 492,721; US 5,428,467; WO 95/26110; Kokai 08-211,358, 08-022,006. None of these references shows a continuously scrolling architecture, which is characteristic of the scrolling color illumination systems of the invention.

It is an object of the invention to provide a scrolling stripe illumination system which suppress color artifacts in a color projection system.

This object is achieved by the scrolling stripe illumination system according to the invention as specified in Claim 1.

Single panel scrolling color projection systems using three (red, blue and green -- RGB) scrolling color bands have been demonstrated to be adequate for television images. However, computer graphics are more prone to color artifacts. The invention increases the number of scrolling color bands in order to suppress these artifacts. One

implementation of the scrolling multi-stripe color illumination system comprises breaking up the three color stripes into multiple stripes using a lenticular lens array, collimating the multiple stripes with a second lens array, and scrolling the collimated stripes using a rotating prism of the prior systems.

Another implementation of scrolling multi-stripe color illumination system of the invention comprises a polarizing beamsplitter, which reflects light from a source through a lens subsystem and a quarter waveplate onto a rotating drum, from which multiple colored stripes are retro-reflected back through the lens subsystem and the quarter waveplate, which enables the retro-reflected light to pass through the polarizing beamsplitter, and the retro-reflected multiple colored stripes produced are directed onto a light valve, producing a scrolling pattern of colored light.

By exposing the eye to multiple color stripe images, rather than a single one, during rapid eye movements, the impression of a different color in the peripheral vision region is removed. The scrolling color system lends itself particularly well to such a solution. Unlike the "write, wait and expose" sequence used in other color sequential systems, the system of the invention enables continuous addressing of an arbitrary number of color stripes without adding overhead.

Further advantageous embodiments of the image processing system according to the invention are specified in the dependent claims.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawing:

FIG. 1 shows a color projection system comprising illumination optics for creating multiple color stripes on a display and

FIG. 2 shows part of another illumination optics for creating multiple color stripes on a display.

Fig 1 shows a color projection system comprising a lamp 10, a reflector 11, a slit 12, a polarizing beam splitter 13, a lens 14, a quarterwave plate 15, a lens 16, a rotating drum 17, a lens 18 and a light valve 19.

In FIG. 1, light from lamp 10 is reflected and directed by reflector 11 though slit aperture 12 and onto polarizing beamsplitter 13, where it is reflected through focusing lens 14, quarter waveplate 15 and focusing lens 16 onto rotating drum 17. Multiple colored

stripes are retro-reflected back from the rotating drum 17 through lens 16, through quarter waveplate 15, which enables the retro-reflected light to pass through the polarizing beamsplitter 13 after it passes through lens 14. The retro-reflected multiple colored stripes produced are then directed through focusing lens 18 onto light valve 19, creating a scrolling pattern of colored light. The drum 17 rotates at a relatively slow rate. A motion corresponding with one RGB stripe period requires a full RGB refresh of the panel.

FIG. 2 shows part of another illumination optics system for creating multiple color stripes. Three colored beams 30, formed from a single beam of white light by means of dichroic filters (not shown) are broken up into an array of color stripes using a lens array 31. A second array 32 coplanar with the color stripes, recollimates the off-axis light so that the light entering the refractive scanning prism 33 is telecentric. The virtual image 34 of the stripe pattern moves vertically as the prism 33 rotates. This secondary source is imaged onto the light valve 36 after passing through relay 35.

The foregoing has shown and described a novel scrolling multi-stripe color illumination system, which fulfills all the objects and advantages sought therefor. Many changes, modifications, variations and other uses and applications of the subject invention will, however, become apparent to those skilled in the art after considering this specification which discloses the preferred embodiments thereof. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention, which is to be limited only by the claims which follow.

CLAIMS:

1. A scrolling color illumination system comprising means for generating a color stripe and means for scrolling the color stripe characterized in that the means for generating a color stripe are arranged for generating more than three color stripes and the means for scrolling the color stripe are arranged for scrolling the more than three color stripes.

2. A scrolling multi-stripe color illumination system as claimed in claim 1 wherein the three colors are red, blue and green.

3. A scrolling multi-stripe color illumination system as claimed in claim 1 which comprises breaking up the three color stripes into multiple stripes using a lenticular lens array, collimating the multiple stripes with a second lens array, and scrolling the collimated stripes using a rotating prism.

4. A scrolling multi-stripe color illumination system as claimed in claim 1 which comprises a polarizing beamsplitter, which reflects light from a source through a lens subsystem and a quarter waveplate onto a rotating drum, from which multiple colored stripes are retro-reflected back through the lens subsystem and the quarter waveplate, which enables the retro-reflected light to pass through the polarizing beamsplitter, and the retro-reflected multiple colored stripes produced are directed onto a light valve, producing a scrolling pattern of colored light.

5. A color projection system comprising the scrolling color illumination system as claimed in claim 1.

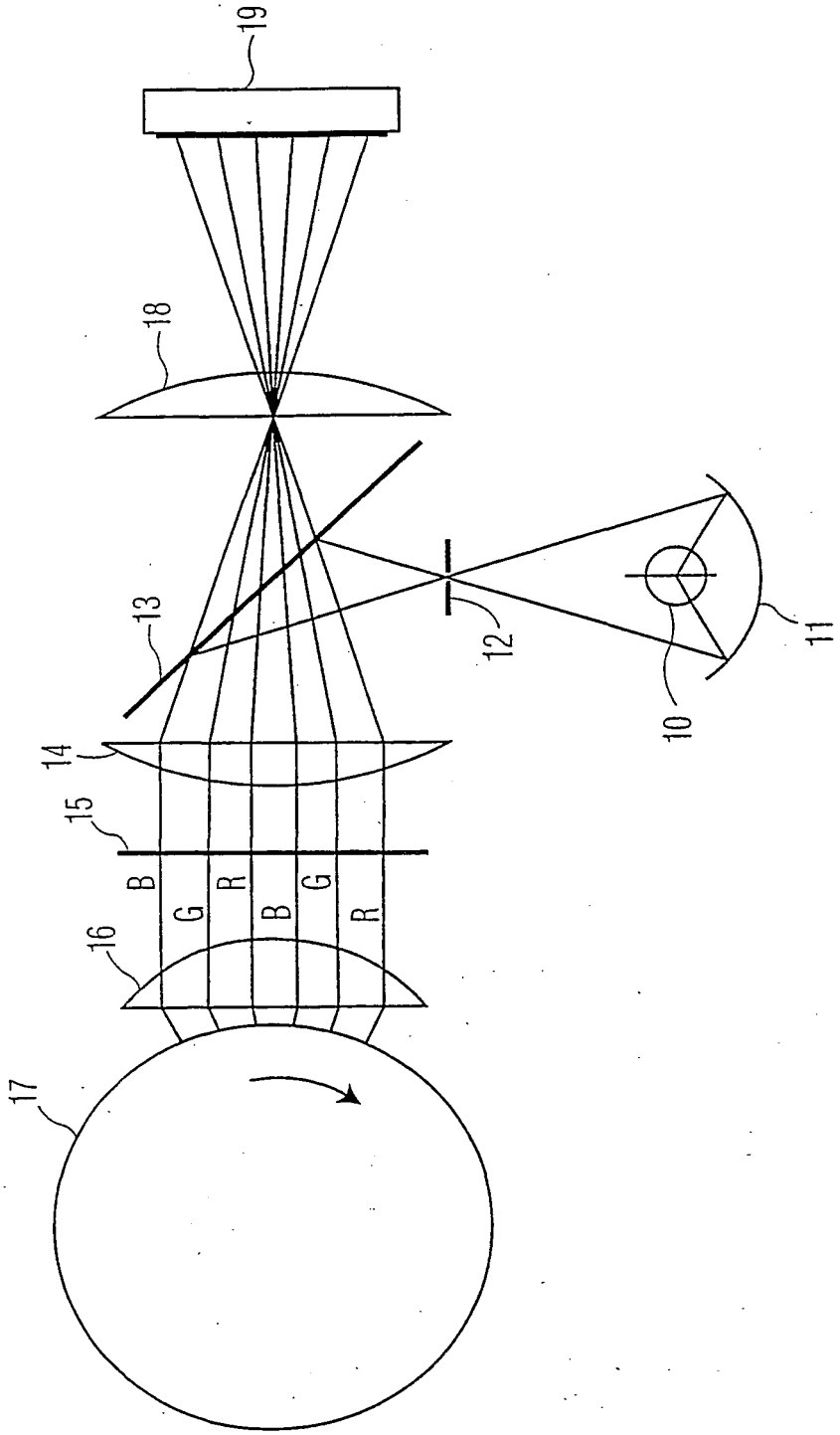

FIG. 1

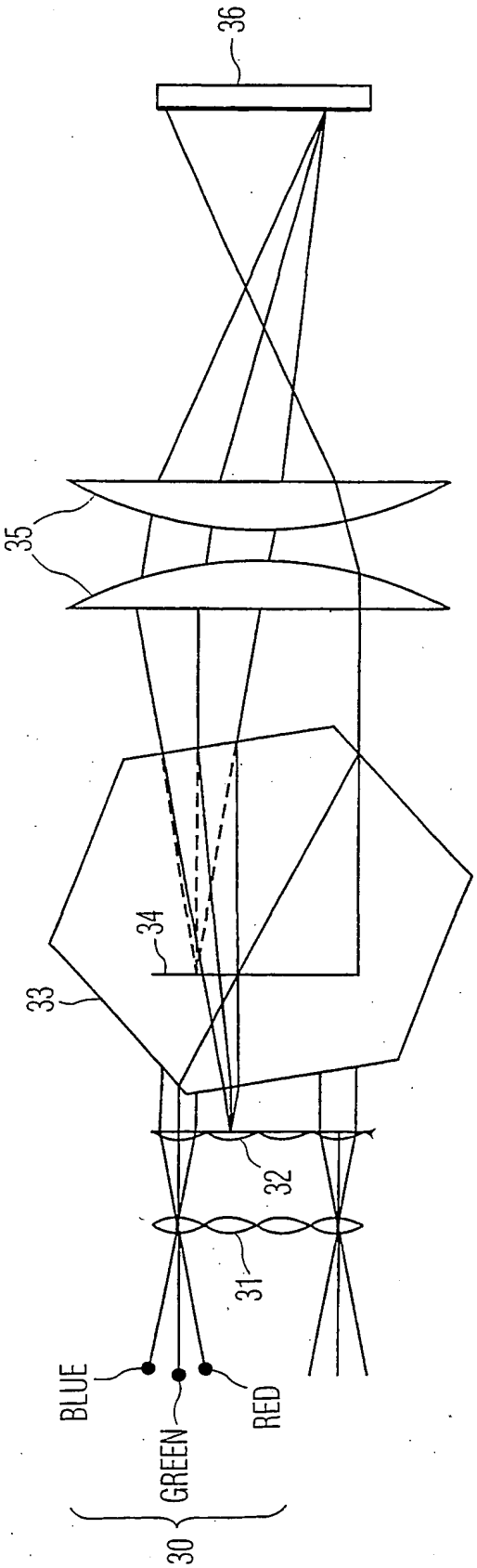

FIG. 2

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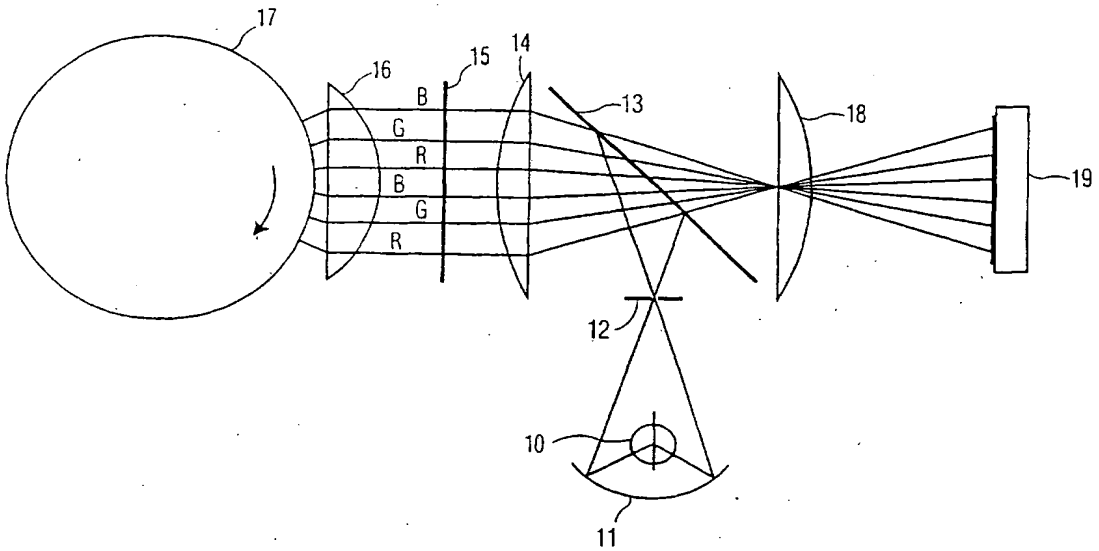

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B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
PAJ, EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 08, 6 October 2000 (2000-10-06) & JP 2000 137191 A (IBM JAPAN LTD;APUTEI:KK), 16 May 2000 (2000-05-16)	1,2,5
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A	EP 0 601 666 A (KONINKL PHILIPS ELECTRONICS NV) 15 June 1994 (1994-06-15) abstract; figures 1,2	1-5

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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